REMARKS

Entry of the amendments to the claims before examination of the application is respectfully requested.

If there are any questions regarding this Preliminary Amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

Respectfully submitted,

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CLIMATE CONTROL METHOD

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The invention relates to a climate control method ~~as claimed in the precharacterizing clause of claim 1~~.

[0002] DE 43 31 142 C2 discloses a method by means of which the internal area temperature is always regulated to the nominal internal area temperature setting irrespective of the respectively prevailing temperature of the external area from which, for example, the internal area medium is taken in the case of a motor vehicle air-conditioning system, by appropriate adjustment of the temperature of the flowing-in medium. If required, the medium is cooled-down [and/]or heated for this purpose before it flows ~~flowing in~~ into the vehicle.

[0003] In the case of vehicles with temperature and/or fan control, it is likewise known for the blowing-in temperature of the air-conditioning system to be calculated as a function of the outside temperature, the internal area temperature and a nominal internal area temperature setting.

[0004] However, the problem with climate control methods such as these is that, when the outside temperatures are very high, for example between 35°C and 55°C and/or there is additional solar radiation, a very low nominal blowing air temperature, for example -30°C to -60°C, is calculated. For physical reasons, specifically icing up of the vaporizer, the lowest blowing-in temperature is, however, about 3°C to 5°C. If an occupant wishes to be warmer, and changes the nominal value from 22°C to, for example, 24°C, the calculation of the nominal blowing-air temperature is increased only to about -10°C to -20°C. Since, however, the blowing-out temperature is physically limited to 3°C to 5°C, and a blowing air nominal temperature of down to -60°C is calculated, the nominal value change is not detectable for the occupant. The nominal value must be set even higher depending on the values of the control parameters, that is to say the outside temperature, the nominal value, the influence of the sun (the solar

radiation) and the internal area temperature until a positive blowing air temperature is calculated by the climate control calculation.

[0005] One object of the present invention is to develop a climate control method such that the climate control responds immediately to a change in a nominal value even when the outside temperatures are very high and/or the solar radiation is strong.

[0006] According to the invention, this object is achieved by a climate control method ~~having the features as claimed in claim 1~~ .

[0007] The control system according to the invention makes it possible to achieve a detectable reaction to a manual action.~~, that is to say~~ In other words, the nominal internal area temperature is increased even though a nominal blowing-in temperature calculated for this nominal internal area temperature, in the same way as a previous nominal blowing-in temperature for a lower nominal internal area temperature, is not feasible owing to the physical limits and, Conventionally ~~conventionally~~, the lower limit value of the blowing-in temperature was used as standard in both cases.

[0008] In particular, the method according to the invention can also and in particular be used for multiple zone air-conditioning systems since more comfort for the individual seat positions can now be achieved in this case, since it is possible to adapt the blowing-in temperature separately for each area.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] These and further objects, features and advantages of the present invention will become clear from the following description of one preferred exemplary embodiment, in conjunction with the drawing, in which:

[0010] Figure 1 shows a flowchart of the climate control method according to the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0011] Conventional climate control methods are subject to the problem that the blowing-in temperature $T_{blowing\text{-}in\text{-}min}$ cannot be below 1°C to 3°C owing to the physical limit of the vaporizer icing up, even though a calculated nominal blowing-in temperature would be considerably lower. Because of this, it is impossible, if the outside temperatures are high and/or the solar radiation is severe, to provide a nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ which is calculated as a function of the outside temperature T_A, the actual internal area temperature T_I and a nominal internal area temperature setting T_{Inom}. In a situation such as this, even in the event of a readjustment by increasing the nominal internal area temperature, it is possible for the nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ calculated using the new nominal internal area temperature $T_{Inom\text{-}new}$ still to be well below the achievable value, as well. The occupant therefore cannot detect any control change, so that he requires several manual readjustment processes until he is provided with a blowing-in temperature $T_{blowing\text{-}in}$ which is comfortable for him. This is where the air-conditioning method according to the invention comes into play, in order to provide a modified form of climate control in this case, with which this problem no longer occurs.

[0012] The climate control method according to the invention will now be described in the following text with reference to Figure 1.~~, with this~~ This method ~~allowing~~ allows the problem described above to be overcome and ~~allowing~~ allows a comfortable control for the occupant or occupants.

[0013] In the climate control method according to the invention, the conventional method is first of all used in a first step S1 to calculate the nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ as a function of the outside temperature T_A, the actual internal area temperature T_I and the nominal internal area temperature $T_{I\ nom}$. Then, in a step S2, the calculation result, that is to say the nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ is compared with the minimum

physically achievable blowing-in temperature $T_{blowing\text{-}in\text{-}min}$. If it is found in the step S2 that the calculated nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ is higher than the minimum blowing-in temperature $T_{blowing\text{-}in\text{-}min}$, conventional climate control is carried out in step S3, as a function of the actual internal area temperature T_I, the nominal internal area temperature T_{Inom}, the outside temperature T_A and, if appropriate, the solar radiation q, and the speed v, etc. If~~, in contrast,~~ the calculated nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ in step S2 is below the minimum blowing-in temperature $T_{blowing\text{-}in\text{-}min}$, a check is carried out in step S4 to determine whether there is a new nominal internal area value $T_{Inom\text{-}new}$. If there is no such value, an internal area temperature normal value, for example of 22°C, is used instead of this, and the process returns to step S1.

[0014] If there is a new nominal internal area value $T_{Inom\text{-}new}$, a nominal internal area temperature change Δt_{Inom} is then calculated in step S5 from the difference between $T_{Inom\text{-}new}$ and $T_{Inom\text{-}old}$. A check is then carried out in step S6 to determine whether the nominal internal area temperature change ΔT_{Inom} is greater than zero, that is to say whether the manual action should result in a temperature increase. If there is no temperature increase, that is to say the nominal internal temperature change ΔT_{Inom} is present, the process returns to step S1, otherwise it progresses to step S7. In step S7, a second nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom2}$ is now calculated as a function of the nominal internal area temperature change ΔT_{Inom} and the outside temperature T_A. The calculation is carried out with reference to empirical values determined by measurements for optimum control. A maximum of the nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ and the second nominal blowing-in temperature is then determined is step S8. A check is then carried out in step S9 to determine whether the second nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom2}$ has been chosen as a maximum. If this is the case, the outlet valve, in the case of several zones, the outlet valve in the respective zone, is closed in step S10. Otherwise the process returns directly to step S1.

[0015] In one preferred development of the invention, the climate control method according to the invention is used for multiple zone air-conditioning

systems in such a way that the climate control process described above with reference to Figure 1 is carried out for each of the temperature preselection devices for the various zones as soon as the calculated nominal blowing-in temperature $T_{blowing\text{-}in\text{-}nom}$ is below the physically minimum possible blowing-in temperature $T_{blowing\text{-}in\text{-}min}$. This allows very comfortable climate control to be carried out separately for each separately air-conditioned vehicle area, so that occupants located in a different area are not also affected by the climate control, so that their comfort is not adversely affected either.

Patent Claims

1. A climate control method, by means of which the internal area temperature is always regulated to the nominal internal area temperature setting taking into account the respectively prevailing temperature of the external area from which the internal area medium is taken, by appropriate adjustment of the temperature of the flowing-in medium (the blowing-in temperature), with the medium being cooled down and/or heated if required before flowing in,

characterized by the following steps,

(Step S1) calculation of a nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom}$) as a function of the outside temperature (T_A), the actual internal area temperature (T_I) and the nominal internal area temperature (T_{Inom}),

(Step S2) comparison of the calculated nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom}$) with a minimum physically achievable blowing-in temperature ($T_{blowing\text{-}in\text{-}min}$),

(Step S3) if step S2 shows that the nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom}$) is above the minimum blowing-in temperature ($T_{blowing\text{-}in\text{-}min}$), carrying out conventional climate control as a function of the actual internal area temperature (T_I), the nominal internal area temperature (T_{Inom}), the outside temperature (T_A) and, optionally, the solar radiation (q) and/or the vehicle speed by controlling the blowing-in temperature ($T_{blowing\text{-}in}$) and/or the air mass flow,

(Step S4), if the nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom}$) is below the minimum blowing-in temperature $T_{(blowing\text{-}in\text{-}min)}$, determination of whether a new nominal internal area temperature ($T_{Inom\text{-}new}$) has been entered by at least one of the occupants via a nominal internal temperature setting device,

if no new nominal internal area temperature ($T_{Inom\text{-}new}$) has been found in S4, return to step S1

(Step S5) if a new nominal internal area temperature $T_{Inom\text{-}new}$) has been found in step S4, determination of a nominal internal temperature change (ΔT_{Inom}) from the difference between the new nominal internal area temperature ($T_{Inom\text{-}new}$) and the previous nominal internal area temperature ($T_{Inom\text{-}old}$),

(Step S6) determination of whether the nominal internal area temperature change (ΔT_{Inom}) has a value greater than zero,

if the nominal internal area temperature change (ΔT_{Inom}) has a value less than or equal to zero, return to step S1,

(Step S7) if the nominal internal area temperature change (ΔT_{Inom}) has a value greater than zero, calculation of a second nominal internal area temperature as a function of ΔT_{Inom} and T_A,

(Step S8) selection of the maximum value of the nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom}$) and of the second nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom2}$),

(Step S9) with a decision then being made as to whether the second nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom2}$) has been selected,

if the second nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom2}$) has not been selected in step 9, return to step S1,

(Step S10), if the second nominal blowing-in temperature ($T_{blowing\text{-}in\text{-}nom2}$) has not been selected in step S9, the outlet valve is closed, and then return to step S1.

2. The climate control method as claimed in claim 1, characterized in that the calculation of the second nominal blowing-in temperature ($T_{(blowing\text{-}in\text{-}nom2}$) is carried out as a function of the outside temperature (T_A) and of the nominal internal area temperature change (ΔT_{Inom}) on the basis of reference curves determined by measurement.

3. The air-conditioning control method as claimed in claim 1 or 2, characterized in that if there is no previous nominal internal area temperature ($T_{Inom\text{-}old}$), a temperature value which is regarded as being comfortable is selected instead.

4. The air-conditioning control method as claimed in claim 1, 2 or 3, characterized in that the temperature value is 22°C.

5. The air-conditioning control method as claimed in one of claims 1 to 4, characterized in that the method is carried out separately in a multiple zone air-conditioning system for each separately air-conditioned vehicle area.

Abstract

The present invention discloses a climate control method, in which a distinction is drawn between climate control corresponding to a conventional method, and a modified climate control process. The modified climate control according to the invention is used when an occupant wishes to have less cooling, and thus raises the nominal internal temperature, after being cooled down to the physical limit, that is to say the minimum blowing-in temperature, before the vaporizer ices up, for example when the outside temperatures are very high. Since, in a situation such as this, the nominal blowing-in temperature both for the previous nominal internal area temperature and for the new, higher nominal internal area temperature is still well below the physically achievable limit, a second nominal blowing-in temperature is now calculated, in which the nominal internal area temperature change and the outside temperature are taken into account. The actual blowing-in temperature is controlled as a function of which of the two nominal blowing-in temperatures is the maximum. In this way, it is possible to achieve a direct response to the increase in the nominal internal area temperature even if the conventionally calculated nominal blowing-in temperature were still below the physically achievable blowing-in temperature.

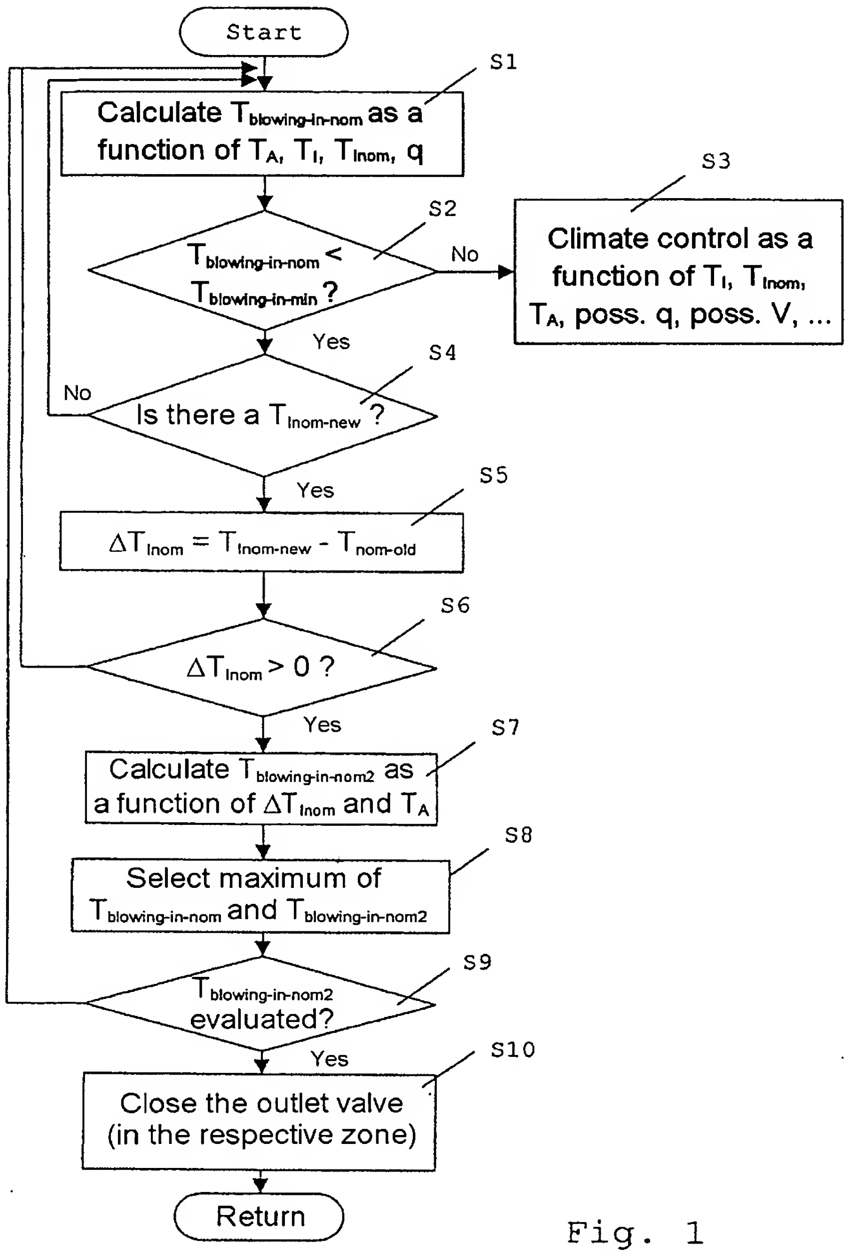
Start
S1
Calculate $T_{blowing-in-nom}$ as a function of T_A, T_I, T_{Inom}, q
S2
$T_{blowing-in-nom}$ < $T_{blowing-in-min}$?
No
S3
Climate control as a function of T_I, T_{Inom}, T_A, poss. q, poss. V, ...
Yes
S4
No
Is there a $T_{Inom-new}$?
Yes
S5
$\Delta T_{Inom} = T_{Inom-new} - T_{nom-old}$
S6
$\Delta T_{Inom} > 0$?
Yes
S7
Calculate $T_{blowing-in-nom2}$ as a function of ΔT_{Inom} and T_A
S8
Select maximum of $T_{blowing-in-nom}$ and $T_{blowing-in-nom2}$
S9
$T_{blowing-in-nom2}$ evaluated?
Yes
S10
Close the outlet valve (in the respective zone)
Return

Fig. 1